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GRANITE ROCKS OF BUTTE, MONT., AND VICINITY¹

IN the western mountainous part of Montana there are several extensive areas of granitic rocks, which are commonly surrounded by sedimentary beds and in part covered by later volcanic rocks. The largest of these granite masses forms a mountainous area having no commanding summits, but constituting the continental water parting separating the waters of the Atlantic from those tributary to the Pacific Ocean. This district is largely drained by the Boulder River, and as the mountains have no other name, they too are sometimes called by this name, for which reason it will be used to designate the intrusive mass of granite itself. Unmistakable evidences of intrusion are common about its borders, and as the rock cuts and metamorphoses fossiliferous Carboniferous rocks and what are believed to be Cretaceous rocks as well, and is overlaid by Neocene sediments, its age is known within these limits.

The Boulder batholith is a body of granitic rock, in part covered by later lavas, but continuously exposed from the Highland Mountains (sixteen miles south of Butte) to the vicinity of Helena, a distance of fifty miles in a north and south direction and twenty-four miles from east to west. The intrusive nature of the mass is very strikingly shown at the northern and southern limits, and also at Elkhorn on the east. At these places the granitic rocks have produced very marked contact metamorphism, and cut across the ends of the upturned sedimentary series. Near its border the granite also includes in its mass fragments of the other rocks. There is no suggestion of a laccolithic uplifting, for although near Helena, and probably elsewhere, the granitic rocks extend outward under the sedimentary rocks, and the latter in certain places form a thin cover over the intrusion, yet the strata dip toward the intrusion conformable to a great anticlinal uplift wholly independent of the batholith.

¹ Published by permission of the Director of the U. S. Geological Survey.

The rocks of this batholith present a wide variation in mineral and chemical composition, but a study of the field relations shows they must be regarded not only as facies of the same magma, but as parts of one mass. The very basic rocks all occur at the margins, yet there are variations within the main body itself which are clearly recognizable rock types, yet cannot be discriminated in mapping. This difficulty has been experienced by those geologists working in the Sierra Nevada, where, as stated by Turner,¹ a considerable variety of rock-types have been mapped as granodiorite, "although, as a rule, gabbro, even when genetically related to granodiorite proper, has been separated." Where detailed mapping upon a large scale map is not possible, this difficulty of separating parts of a single intrusive body in which the rock-types grade into one another can only be met by an arbitrary use of the name of the prevailing rock-type for the entire mass, as has commonly been done heretofore, or by using a generic term like *granolite*² to embrace all coarsely granular rocks.

The prevailing rock of the batholith is a granite whose composition is that given under the number 518. It is a normal hornblende-granite which is very generally sheeted, forming picturesque crags and boulder groupings. It disintegrates readily into platy masses or shells which separate from the boulders, and themselves crumble to a coarse sand. Over large tracts disintegration has reduced the rock to a smoothly rolling surface, on which scattered boulders rise above the general level. Perfectly fresh material can, therefore, be obtained only where the rock has been quarried or exposed by mining operations. It is a medium to coarse-grained rock, the average size of the grains being 3–5 mm. The grayish quartz and white feldspar grains are of about equal size. Black mica and dark green hornblende are present in considerable quantity. Under the microscope it shows the normal characters of a granite, but contains an unusual amount of plagioclase.

¹ H. W. TURNER: Granitic rocks of Sierra Nevada, *JOUR. GEOL.*, Vol. VII, 1899, p. 146.

² See TURNER: *loc. cit.*, p. 141.

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In the following table the results are given of the analyses so far made of the rocks of the Boulder batholith :

ANALYSES OF ROCKS FROM THE POST-CRETACEOUS GRANITIC BATHOLITH OF THE BOULDER MOUNTAINS, MONTANA

				Butte granite						Aplites	
	526	525	130	311	623	6	989	98	518	640	951
SiO ₂	49.22	56.41	61.64	63.87	63.88	64.05	64.34	64.17	67.12	76.87	77.05
TiO ₂	0.95	0.68	.71	.65	.65	.60	.53	.67	.48	.11	.12
Al ₂ O ₃	12.02	17.62	15.63	15.39	15.84	15.38	15.72	15.25	15.00	12.52	12.84
Fe ₂ O ₃	2.77	1.24	3.39	1.93	2.11	2.20	1.62	2.16	1.62	0.67	.56
FeO.....	8.80	3.55	2.69	3.08	2.59	2.74	2.94	2.98	2.23	none	.14
MnO.....	tr	.08	.04	.11	.07	.11	.12	.04	.06	...	none
CaO.....	10.56	8.66	4.90	4.30	3.97	4.30	4.24	4.24	3.43	0.49	.57
MgO.....	9.29	3.97	2.82	2.23	2.13	2.08	2.17	2.60	1.74	0.09	tr
K ₂ O.....	1.70	2.61	3.72	4.18	4.23	4.00	4.04	4.34	4.52	5.78	5.52
Na ₂ O.....	1.90	3.35	2.64	2.76	2.81	2.74	2.76	2.62	2.76	2.47	2.81
H ₂ O below 110°	0.27	.14	.28	.19	.22	.27	.25	.16	.09	0.25	.22
H ₂ O above 110°	1.63	.76	.91	.69	.66	.83	.76	.65	.58	0.52	.48
BaO.....	.03	.09	.08	.07	.09	.08	.06	.07	.07	...	none
SrO.....	.03	.08	.04	.04	.02	.04	.03	tr	.03	...	none
P ₂ O ₅	0.43	.49	.21	.17	.21	.21	.14	.16	.15	.05	none
Cl.....	.08	.07	...	...	...	...	...	tr	...	...	...
S.....	.05	...	...	.07	...	.07	.03	...	...	...	none
SO ₃.....	.04	...	none	...	...	...	...	.07	tr	...	...
CO ₂.....	...	...	none	.15	...	.35	.03	none	none	...	none
Totals.....	99.77	99.70	99.70	99.91	99.72	100.05	99.80	100.18	99.88	99.82	100.31

H. N. Stokes, Analyst.

526, 525. Contact facies of granite mass, Red Mountains.

130. Diorite, Red Rock Creek, intrusive in batholith.

311, 623, 6, 989. Butte type of granite, Butte district.

98. Head of Clancey Creek, northern part of batholith.

518. Prevailing type of granite of batholith, Boulder.

640, 951. Aplites of Butte granite, Butte.

The following table shows the chemical composition of this rock, only the essential elements being given, the complete analysis being shown in the preceding table. Partial analyses of quartz-monzonite from the Sierra Nevada¹ and of Brögger's adamellite² are given for comparison.

¹H. W. TURNER: The granitic rocks of the Sierra Nevada, JOUR. GEOL., May 1899, p. 141.

²Die eruptionsfolge der triadischer Eruptivgesteine bei Predazzo, p. 62.

	Boulder Granite	Quartz Monzonite	Granodiorite	Adamellite
		²¹⁷⁹ Sierra Nevada	Pyramid Peak	Landsberg bei Barr Vogesen Rosenbusch
SiO ₂	67.12	66.83	67.45	68.97
Al ₂ O ₃	15.	15.24	15.51	14.80
CaO	3.43	3.59	3.60	3.82
MgO	1.74	1.63	1.10	1.15
K ₂ O	4.52	4.46	3.66	4.53
Na ₂ O	2.76	3.10	3.47	2.40

The close similarity of this rock to the quartz-monzonites of the Sierra Nevada is apparent from these figures. It is evident from the analyses that the Boulder granite nearly corresponds to Brögger's adamellite.

THE BUTTE GRANITE

The Butte granite (or quartz-monzonite) covers an area of several square miles and is the prevailing rock of the Butte district, and the one in which the world-famous copper and silver veins of that place occur. It is, therefore, of more than ordinary interest, and has been carefully investigated in connection with the study made of the general and economic geology of the district. It is a rather dark colored, coarsely granular rock which is seldom seen in conspicuous exposures about the productive mines owing to a close sheeting with much decomposition near the mineral veins and ready disintegration in other parts of the district. Away from the mineralized areas it is well sheeted and forms the usual boulder and castellated forms of such rocks. Its darker tone and greenish feldspars render it easily distinguished from the boulder type. Throughout the entire district it is very uniform in appearance, as it proves upon analysis to be in composition, though differing somewhat in the relative proportions of the constituent minerals. It is also uniform in grain over the entire district, but hand specimens show in local patches a variation of textures. Inclusions of a much darker and finer-grained dioritic rock are often seen weathered in relief on exposed surfaces; they are always small, seldom over a few inches across, angular and rather scarce, never making an appreciable part of

the mass. Owing to disintegration perfectly fresh specimens can only be obtained from surface quarries or underground workings. The exact relations of this mass to the general area were not satisfactorily determined, though it appears certain from the exposures that it is an integral part of the batholith and not a separate intrusion. At several localities a sharp gradation was observed, with narrow transition bands between the lighter colored granite with its white feldspars and the darker Butte type.

Orthoclase is an abundant and usually a readily recognizable constituent as its pinkish color is in contrast to the green tones of the plagioclase, and it has, moreover, a tendency to develop in relatively large crystals which give the rock a somewhat porphyritic look. Plagioclase, black hornblende, black biotite, and quartz are easily distinguished by the eye. Under the microscope the rock is seen to vary between a rather basic hornblende-granite and a quartz-diorite. There is usually a slight amount of chlorite present, but the biotite and hornblende are as a rule fresh. Titanite, apatite, iron ore, and zircon are present as accessories. It will be seen that the rock is only a somewhat more basic phase of the granite of the region, and that it closely resembles granodiorite, though in the Butte rock the plagioclase is more basic, being a sodic labradorite. The four analyses given in the general table show the rock to be remarkably uniform in chemical composition over the entire area.

The following table gives partial analyses of the Butte granite and of the related rocks from other localities :

PARTIAL ANALYSES OF BUTTE GRANITE AND RELATED ROCKS

	Butte (average)	Granodiorite (average)	Boise	Banatite (average)	Boulder
SiO ₂	64.03	65.48	65.25	64.39	67.12
Al ₂ O ₃	15.58	16.05	16.94	15.90	15.
Fe ₂ O ₃	1.96	1.47	1.60	} 5.63	1.62
FeO	2.83	3.02	1.91		2.23
CaO	4.20	4.80	3.85	4.15	3.43
MgO	2.15	2.13	1.31	1.93	1.74
K ₂ O	4.11	2.43	3.02	3.57	4.52
Na ₂ O	2.76	3.49	3.57	3.49	2.76

} 6.87

} 7.05

The analysis of the Butte rock is the mean of the four analyses already given. The granodiorite is the mean of five analyses given by Turner.¹ The Boise rock is described by Lindgren.² The Banatite is a mean of the analyses quoted by Brögger.³ From the analyses it will be seen that the rock closely resembles a banatite in composition; the lime and sum total of the alkalis being the same, but in the Butte rock the potash exceeds the soda in amount. It also resembles the granodiorites, but the alkalies present an inverse ratio.

In order to furnish a basis for calculating the mineral composition of this rock, fresh rock was crushed, the hornblende and biotite separated by Dr. H. N. Stokes by the use of Thoulet solution, and these two minerals from each other by sliding on paper. The resulting material was examined under the microscope and found to be quite pure.

The biotite is quite black in color to the eye, but dark brown under the microscope showing very marked pleochroism. This biotite is characteristic not only of the Butte granite but of the Boulder granite as well. In many sections examined it appears the same in color and pleochroism not only for the Butte rock but for the normal granite of the batholith, and it may be assumed to be the same for both these rocks. The microscopic examination of the biotite material showed a little apatite present, a very little chlorite, and very little hornblende, but these impurities form a very minute part of the whole. The amphibole is also characteristic of both the Butte granite and the normal granite of the region. It is black or very dark green when seen with a hand lens, but pleochroic in dark green tints with large extinction angle when seen under the microscope. The material analyzed was very pure.

The following table shows the result of the analyses made of these minerals. Dr. Stokes was unable to obtain a higher

¹ Loc. cit., p. 150.

² Mining Districts of the Idaho Basin and Boise Ridge, Idaho. Eighteenth Ann. Rept. Director U. S. G. S. 1898, p. 740.

³ Loc. cit., p. 62.

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summation in the analyses made of each, and the amount of material available being exhausted further work could not be done. For reference the analyses published by Turner of the biotite and amphibole from the quartz-monzonite of the Sierra Nevada, are also given.¹ The close resemblance of the analyses of both rocks and minerals to those of the Butte material will be noted.

	Biotite		Hornblende		Butte granite
	Butte	S N 2652	Butte	S N 2652	
SiO ₂	35.79	35.75	45.73	47.49	64.03
TiO ₂	3.51	3.16	1.43	1.21	.60
P ₂ O ₅ .....	.10	.03	.28	.06	.18
F .....	.76	.17	....	....	.....
Cl .....	.20	....	....	....	.....
Al ₂ O ₃	13.70	14.70	6.77	7.07	15.58
Fe ₂ O ₃	5.22	4.65	4.94	4.88	1.96
FeO	13.72	14.08	10.30	10.69	2.83
MnO .....	.19	.45	.54	.51	.11
BaO .....	.13	....	none	....	.07
SrO	none	.12	none	....	.04
CaO .....	.05	.17	11.25	11.92	4.20
MgO	12.13	12.37	12.32	13.06	2.15
K ₂ O	9.09	9.19	1.22	.49	4.11
Na ₂ O .....	.15	.32	.77	.75	2.76
Li ₂ O	tr	tr	tr	tr	.....
H ₂ O below 110°	1.21	1.03	.49	....	.20
H ₂ O above 110°	3.64	3.64	2.29	1.86	.73
Total	99.59	100.00	98.77	100.03	99.87
Less O for F & Cl .....	.37		.12		
	99.22 Stokes	Hillebrand	98.65 Stokes	Hillebrand	Stokes

The Butte analyses are incomplete as the amount of material was too small for further work.

The phosphoric pentoxide (P₂O₅) in the analyses of both minerals and of the rock itself is assumed to be present as apatite and with an appropriate amount of lime is deducted from the analyses. The water below 110° C. is assumed to be accidental and is also deducted. The analyses are then reduced to 100, and the molecular ratios calculated.

¹ Some rock forming biotites and amphiboles. A. J. Sci. Vol. VII, 1899, p. 294.

All the soda is calculated as albite. Microscopic examination shows the plagioclase to be a calcic andesine Ab_1 , An_1 , and, an estimate being made of the proportion of hornblende present, an equivalent amount of lime is deducted and the remainder calculated with the albite molecule to form plagioclase.

The result gives the following composition for the rock :

	I	II
Quartz - - - - -	23.70	20.8
Orthoclase - - - - -	19.88	18.
Albite - - - - -	22.98	28.
Anorthite - - - - -	11.48	12.1
Hornblende - - - - -	15.26	16.6
Biotite - - - - -	4.22	—
Magnetite - - - - -	1.18	1.5
Titanite - - - - -	.97	1.4
Apatite - - - - -	.33	.3
	<hr/> 100.00	<hr/> 98.7

This adds up to 1.51 molecular weight against 1.50 for the bulk analysis of the rock, showing a very close agreement. As the microscope shows the plagioclase to be andesine of about the composition of Ab_1 , An_1 (or Sodic labradorite), and albite is not seen in the section, the orthoclase must contain the albite molecule. In the second column the percentages given are those calculated by Lindgren¹ for the granodiorite of Grass Valley—a rock whose chemical analysis, as already shown, closely resembles that of the Butte granite.

The rocks in the vicinity of the Frohner mine are identical in composition with the Butte granite, as shown by the analysis. The region is about thirty miles north of Butte, and the rock part of the general granite batholith.

THE BLUEBIRD APLITE

Associated with the Butte granite there is an unusual development of aplite. So far as known to the writer it is the most extensive occurrence of a granite aplite yet discovered. The

¹ Gold Quartz Veins of Grass Valley, Cal., Seventeenth Ann. Rep. Dir. U. S. Geol. Surv., p. 42.

largest mass is $1\frac{1}{4}$ miles by $2\frac{1}{8}$ miles, and is known from mine workings to be several hundred feet thick, resting on the Butte granite. Besides this large mass there is another of about one-third the size and numerous smaller bodies, as outlined by the author on the geologic map of the Butte district. In the cases hitherto observed by the writer, and those commonly described, aplites occur in dikes commonly quite narrow, but often of considerable length; such masses have been supposed to be the filling of cracks formed in the cooling granite, the aplite magma coming either from an acid residuum or nucleus of the mass or, as suggested by Turner, a product squeezed out of the crystallizing granite and gathered in cracks due to its shrinkage. A study of the Butte aplites shows that, though the dikes of this material may owe their origin to some such cause, that the irregular lense-like or meniscoid masses are sometimes local bodies unconnected with any feeder. The inference derived from a careful examination of many exposures is that the material is due to some such process as that suggested by Turner—a sort of segregation. In the description of the remarkable differentiation zone of Square Butte¹ it was shown that the basic outer part of the intrusion, itself a product of differentiation, holds a thin band of white syenite due to further separation or differentiation of the feldspathic constituents in the crystallizing mass.

This hypothesis, my belief in which has been strengthened by further observations of other laccoliths in the same region, seems to explain the manner of occurrence of the aplites in the Butte mass. It is believed, upon evidence which cannot be presented here, that the Butte district is on the downthrown side of a fault and that its granitic rocks represent the upper part of the batholithic intrusion. In this uppermost part of the intrusion partial differentiation is believed to have taken place, the normal granite, represented by analysis No. 516, splitting up into the more basic phase represented by the Butte type and the acidic type, the Bluebird aplite. This hypothesis demands that as the Butte granite

¹ WEED and PIRSSON: Highwood Mountains of Montana, Bull. Geol. Soc. Am., p. 406, 1896.

is but slightly more basic than the prevailing form, the proportion of aplite should be small. The field observations show a quantitative relation which, as far as it can be estimated, confirms the view.

This hypothesis implies a gathering of the iron, magnesian, and lime molecules out of the general magma and their concentration in the quartz-monzonite, with a separation out of the aplitic material, richer in alumina, alkalis, and silica which did not form an inner kernel as it has in laccolithic differentiations, but local masses in the basic granite. This hypothesis has already been anticipated by Cross in the discussion of evidence of differentiation at Rosita, Colo.¹

If the Butte granite is a border or upper contact facies of the batholith, this separation may have been induced by contact cooling. Observations of many of the smaller intrusive stocks of the Montana mountains and of the contacts of the larger batholiths show that there is more or less of a mixing of basic and siliceous materials as if they were stirred together while pasty. The rocks grade into one another and there are no sharp contacts.

In the large aplite intrusions there is no sahlband alteration. The grain continues the same in both rocks, but at a certain line there is a change in the relative proportions of the minerals. In the smaller bodies and little dikelets the grain of the aplite is finer, though there is no contact band or evidence of chilling. In the Butte area this is uncommon. There is, it is true, a sharp contact between granite and aplite, but there are transition forms and even masses of granite in the larger aplite bodies which are clearly not included fragments but integral parts of the mass. Yet there is commonly a definite separation of the two rocks, and it is certain that there has been no mixing of the two materials due to convection or movement before consolidation.

In most of the aplite bodies the grain varies considerably from place to place; sometimes the rock becomes a micropegmatite,

¹ Geology of Silver Cliff and Rosita Hills, Colo., Seventeenth Ann. Rep. Dir. U. S. Geol. Surv., p. 329.

rarely a coarse pegmatite. There is sometimes a banding with alternations of fine and coarse-grained material.

The commonly accepted theory of the origin of aplite is that it represents the acid remainder in a granite or quartz-diorite magma after the more basic elements have crystallized. At a late period, after the main mass of the granitoid rock had crystallized, the aplite is forced up from below and fills previously formed cracks, which are perhaps the result of cooling. Viewed in this light they are genetically related to the more basic granites with which in the Sierra Nevada they are for the most part directly associated.¹

The aplite.—The following calculation of the mineral composition of the aplite, column I, is based upon the complete chemical analyses given in the table. A little biotite is found in the fresh aplite. This is similar to that of the granite and is supposed to have the same composition, and all the magnesia is ascribed to this. This leaves an excess of 0.09 of TiO_2 , which is calculated as titanite.

	I	II
Quartz - - - -	37.70	39.45
Potash feldspar - - -	33.90	29.43
Soda feldspar - - -	23.81	23.03
Lime feldspar - - -	2.45	6.56
Biotite - - - -	0.72	.90
Magnetite, etc. - - -	1.20	.58
Titanite - - - -	0.22	.18
	<hr/> 100.00	<hr/> 100.00

In column II the mineral compositions of the aplites of the Granodiorite of the Sierra Nevada, given by Turner, are given for comparison.

LAMPROPHYRIC CONTACT FACIES

The first two analyses in the large table represent the compositions of two lamprophyric contact facies of the batholith. The rocks probably grade into the granite, though the transition is a

¹ H. W. TURNER: *Geology of Sierra Nevada*, p. 722.

rapid one. More often such rocks occur as intrusions in the altered sediments about the border of the batholith. The first analysis is that of a rock that might be called a diorite, though it hardly comes under that name. It consists mainly of green hornblende, which is stringy and appears to be derived from augite, and of small zonally built basic plagioclase feldspars and a very little quartz. It is a nearly black, quite coarsely crystalline rock, and is an unusual type. It occurs intrusive in phyllites and schists on the summit of Red Mountain, ten miles south of Butte.

The second analysis is that of a rock fairly typical of the batholith contact at many localities. It is a dark gray granular rock, rather finer grained than the granite into which it can in some places be traced by insensible gradations. It is a very basic diorite which approaches a hornblende-gabbro. The hornblende is quite stringy and of uralitic appearance, pale green passing into deeper green and into colorless forms. Brown biotite is rare. Orthoclase is present in small amount and only in interstices between more idiomorphic plagioclase. The latter shows an extremely fine zonal structure and varies between labradorite and albite, and will perhaps in a majority of cases have an average composition corresponding to andesine. A very little quartz is also present, together with apatite and iron ore as accessories.

The rock grades into one consisting mainly of zonally built basic plagioclase in small idiomorphic crystals, equal in amount to that of the combined dark colored constituents, brown pleochroic biotite and hornblende derived from light colored pyroxene, remnants of which still remain.

For the purpose of determining what changes, if any, are accomplished in the ordinary weathering of the granite, an analysis of a coherent but quite friable rock has been made. The material, which is quite typical of that commonly seen in natural exposures, is rather lighter in color than the perfectly fresh rock and has a clayey odor when moist. The greenish plagioclase and pinkish feldspar has been bleached to a dull white or waxy

tint. In the still more altered rock, and in the sands formed by its crumbling down, the white minerals are stained by iron rust. In the rock analyzed the biotite is partly fresh and unaltered, but many of the grains are dull and lusterless, and others are altered to green chlorite; more rarely the cleavages are coated by iron rust. The hornblende shows the most alteration. Some of the grains are fresh, but most of them show masses of ocher, and are penetrated by films of it along cleavages and the grains all show more or less chlorite as the first stage of alteration. These changes all indicate simple hydration and oxidation of the rock, and should accordingly be revealed in the analysis. The following tables show (I) the average composition of the fresh rock, (II) the composition of the disintegrated material, (III) the percentage of each constituent lost, (IV) the percentage of each constituent gained.

Constituents	I	II		III	IV	Limit of possible error of analysis
Silica.....	64.03	65.14	+1.01		1.41	.3
Titanic oxide...	.60	.59	—0.01			
Alumina.....	15.58	15.63	+0.05		0.32	
Ferric oxide	1.96	2.37	+0.51			.1
Ferrous oxide...	2.83	2.13	—0.70			.15
Manganese oxide	.11	tr.	—0.11	100.	10.	
Lime	4.20	3.62	—0.58	14.09		.1
Magnesia	2.15	1.85	—0.30	14.23		.2
Potash	4.11	4.29	+0.13		4.04	.2
Soda	2.76	2.63	—0.13	9.51		.2
Moisture combined.....	.73	.75	+0.02			
Moisture below 110° .....	.23	.37	+0.14			
Baryta .....	.07	.10	+0.03			
Strontia.....	.04	tr.	—0.04			
Phosphoric acid.	.18	.16	—0.02			
	99.86	99.68				

The fresh rock contained a little Cl, 0.17 per cent., the disintegrated rock none. The fresh rock held 0.06 per cent. S (as pyrite), the altered rock 0.05 per cent. SO₃.

While the changes in the character of the rock are largely physical, and its degeneration, due to the rapid expansion and

contraction to which it is here subjected in the extremes of temperature that are so characteristic of the climate, and the chemical changes made possible because of the opportunity for moisture to penetrate the minute cracks thus formed, yet the chemical changes themselves, slight as they appear to be, aid this degeneration by swelling up as the molecules become oxidized and hydrated.

The analysis shows a remarkably small amount of chemical alteration. It is evident, also, that the process is not the normal one of "weathering," since silica is not lost. The presence of sulphides in the rock itself, the proximity of mineral veins, and the presence of sulphurous fumes in the atmosphere which would, of course, acidulate the rainfall, probably account for this abnormal nature of the weathering. Under such circumstances none of the constituents of the rock are constant, since they are all capable of passing into solution under such conditions. As, however, an increase of silica could not take place, this substance must either decrease in amount, or remain constant, and the analyses can be best compared by assuming it constant.

WALTER HARVEY WEED.